

## A METHOD FOR REALIZING THE MULTICAST SERVICE

### Field of the Technology

The present invention relates in general to network communication techniques, and more particularly to a method for implementing multicast services.

### Background of the Invention

With the development of multimedia services such as media streaming, video conference, and video on demand, multicast services have become an important service on the Internet. The multicast service operators are paying more and more attention to such problems as how to efficiently manage multicast users and multicast resources 10 (namely multicast sources) while implementing multicast services, so as to make multicast services diversified and to make multicast users and multicast resources more manageable.

There are three methods for implementing multicast services at present:

For the first method, a router establishes a multicast group address forwarding table 15 in a level-3 network equipment by using an Internet Group Management Protocol (IGMP); when a multicast user joins in a multicast group, the router adds the multicast user's forwarding information to the multicast group address forwarding table and deletes the multicast user's forwarding information from the multicast group address forwarding table when the multicast user leaves the multicast group, so as to dynamically manage the 20 multicast user to join or leave the multicast group. Therefore, the multicast services implemented only through the IGMP can only obtain statuses of the multicast user's joining and leaving the multicast group, and not provide management over whether the multicast user is authorized to join in the multicast group, which is unfavorable to the multiple developments of multicast network operator's services.

25 The second method is to utilize IGMP Snooping techniques to snoop the IGMP packet transferred between multicast users and the level-3 network equipment, like the router and so on, establish and maintain a level-2 multicast group address forwarding table in a level-2 network equipment according to types of IGMP packets, and implement multicast services according to the level-2 multicast group address forwarding table and

the level-3 multicast group address forwarding table.

As shown in Figure 1, the multicast user actively initiates an IGMP leaving packet before leaving the multicast group, so as to notify the router to delete the multicast user's address from the level-3 multicast group address forwarding table; the multicast user initiates an IGMP joining packet before joining in the multicast group, so as to notify the router to add the multicast user's address to the level-3 multicast group address forwarding table; while the router is confirming the multicast user's state by sending an IGMP inquiry packet to the multicast user, if the router fails to receive any inquiry response in a certain period of time, it will delete the multicast user's address from the level-3 multicast group address forwarding table. If the multicast user responds an IGMP report packet to the router after receiving the IGMP inquiry packet, the router will decide whether to add the multicast user to the multicast group or establish a new level-3 multicast group address forwarding table according to the multicast group information carried in the IGMP report packet.

IGMP Proxy is similar to IGMP Snooping, but IGMP Proxy terminates the IGMP packets from multicast users and requests upper-level network equipment for multicast resources as a proxy of the multicast user.

Either IGMP Snooping technique or IGMP Proxy technique just simply implements IGMP protocol, data duplication and forwarding. Both of them lack such management as whether the multicast user is authorized to join in the multicast group. The result is that any multicast user can join in any multicast group, which is unfavorable to the multiple developments of multicast network operator's services.

The third method is to implement multicast services through Access Control List (ACL) on the basis of IGMP Snooping or IGMP Proxy. This method includes:

Firstly, ACL is preset for multicast users who are authorized to use multicast services. For instance, address information 10.10.10.10/24 is set in ACL, and the multicast user whose source IP address is 10.10.10.10/24 can access any multicast group. Secondly, the level-2 network equipment processes the IGMP packet sent by the multicast user by IGMP Snooping technique or IGMP Proxy technique and compares the multicast user's source IP address with the address in ACL. If the multicast user's source IP address

matches the address in the ACL, the multicast user is authorized to join in any multicast group; if the user's source IP address doesn't match the address in the ACL, the multicast user is rejected from joining any multicast group.

In the above method, the multicast users are managed to a certain extent while  
5 multicast services are implemented, but there is no limitation as to which special  
multicast group the user can join in. If the multicast service operator provides or  
purchases some special multicast group resources and only desires to open them to  
special multicast users, this method is unable to satisfy such requirement.

### **Summary of the Invention**

10 Therefore, the present invention provides a method for implementing multicast  
services, so that multicast users and multicast resources can be effectively managed and  
make multicast services diversified.

The method for implementing multicast service includes:

A. a mapping relation between a multicast user address and a multicast group  
15 address is preset;  
B. a request packet sent by the multicast user who requests to join in the multicast  
group is obtained; according to the multicast user address and multicast group address  
carried in the request packet, it is determined whether the multicast group address in the  
request packet matches corresponding multicast group address of the multicast user  
20 among the mapping relation preset in step A, if yes, the multicast user is permitted to join  
in the multicast group, otherwise, the multicast user is rejected from joining in the  
multicast group.

Step A further includes, a mapping relation between the multicast user address and a  
multicast authority is established, and a mapping relation between the multicast authority  
25 and the multicast group addresses is established.

The step of determining whether the multicast group address in the request packet  
matches the corresponding multicast group address of the multicast user among the  
mapping relation preset in step A, further includes: it is determined whether the multicast  
group address in the request packet corresponds to the multicast authority; if yes, whether

the multicast group address in the request packet matches that corresponding to the multicast authority is determined; if yes, the multicast user is permitted to join in the multicast group, otherwise the multicast user is rejected from joining in the multicast group; if the multicast group address in the request packet corresponds to no multicast authority, the multicast user is rejected from joining in the multicast group.

If the multicast group address in the request packet corresponds to no multicast authority in step B, whether the multicast user is a super user is determined; if yes, the multicast user is permitted to join in the multicast group, otherwise the multicast user is rejected from joining in the multicast group.

10 The mapping relation between the multicast user address and multicast group address is one-to-many.

The mapping relation between the multicast user address and the multicast authority are one-to-many or many-to-one, the mapping relation between multicast group addresses and multicast authorities are one-to-many or many-to-one.

15 The multicast user address includes a frame number, a slot number and a port number of a level-2 network equipment to which the multicast user is connected; or the multicast user address includes a frame number, a slot number, a port number, a Virtual LAN (VLAN) identifier and an IP address of a level-3 network equipment to which the multicast user is connected.

20 The level-2 network equipment is Digital Subscriber Line (DSL) broadband access equipment or a Local Area Network (LAN) switcher; the level-3 network equipment is a router or a level-3 switcher.

25 The request packet sent by the multicast user who requests to join in the multicast group is obtained through snooping the request packet via an Internet Group Management Protocol (IGMP).

The request packet sent by the multicast user who requests to join in the multicast group is obtained as follows: an IGMP Proxy terminates the request packet and requests upper-level network equipment for multicast resources as a proxy of the multicast user.

The request packet is based on the IGMP.

By establishing mapping relations among multicast users, multicast authorities, multicast group addresses namely multicast programs, preset multicast resources can be opened to preset multicast users with speed and pertinence. Meanwhile, by establishing  
5 the above-mentioned mapping relations, a multicast user is limited to use a maximum number of allowed multicast services, thus the multicast service bandwidth is effectively controlled and network equipment is effectively protected. The technical scheme of the present invention also makes multicast users and multicast resources manageable and operational, and finally implements diversified multicast services.

10 **Brief Description of the Drawings**

Figure 1 is a schematic diagram illustrating a bandwidth access network;

Figure 2 is a schematic diagram illustrating mapping relations among multicast users, multicast authorities and multicast programs;

Figure 3 is a flowchart illustrating the method for implementing multicast services  
15 according to an embodiment of the present invention.

**Detailed Description of the Invention**

The present invention will be described in detail hereinafter with reference to the accompanying drawings.

The method of an embodiment in the present invention includes: presetting a  
20 mapping relation between multicast users and multicast addresses; when the multicast user requests to use multicast services by sending a request packet, utilizing the multicast service according to a matching result between the multicast group address carried in the request packet and the multicast group address in the preset mapping relation.

Multicast group address refers to a multicast program or multicast source. Each  
25 multicast group address provides one multicast program, in other words, one multicast program is essentially one information stream of the multicast source sent from one multicast group address.

Definition of the multicast user depends on specific location information of the

connection between the multicast user and the network equipment; as to the network equipment, location information can be taken as address information of the multicast user. For instance, as to the level-2 network equipment such as a Digital Subscriber Line (DSL) broadband access equipment, and a LAN SWITCH, the frame number, slot number and port number of the level-2 network equipment can be taken as address information of a multicast user because multicast users can be identified according to the frame number, slot number and port number of the connected equipment; as to the level-3 network equipment like the router, the frame number, slot number, port number, VLAN ID and IP address of the level-3 network equipment can be taken as address information of a multicast user because multicast users can be identified according to the frame number, slot number, port number and VLAN ID of the connected equipment. It should be specially mentioned that, when a plurality of multicast users are connected to the level-2 network equipment that is connected to a certain frame, slot, or port of the level-3 network equipment, it must be guaranteed that each multicast user uses a unique VLAN ID.

Since there are a number of multicast group addresses as well as a number of multicast users, some multicast group addresses can be accessed by all multicast users while some multicast group addresses can only be accessed by specific multicast users. In order to manage the variational multicast users and multicast group addresses better, the preferable way is to establish the mapping relation between multicast users and multicast addresses by setting multicast authorities, namely respectively establishing mapping relations between multicast addresses and multicast authorities as well as mapping relations between multicast authorities and multicast users, and some other properties can be set in the multicast authority, such as time limitation of multicast program that can be obtained by the multicast user. These mapping relations can be stored in the level-3 network equipment or the level-2 network equipment.

Each multicast authority corresponds to at least one multicast program; each multicast program that needs multicast resource management corresponds to at least one multicast authority, and the mapping relations between the multicast authorities and multicast programs are one-to-many or many-to-one. The multicast user to be managed should correspond to at least one multicast authority. If the multicast user does not correspond to any multicast authority, the multicast user is a super user and can join in

any multicast group. Each multicast user to be managed at least corresponds to one multicast authority, and the mapping relations between the multicast user addresses and multicast group addresses are one-to-many or many-to-one.

Since the mapping relation between multicast group addresses and multicast authorities is one-to-many or many-to-one, and so is the mapping relation between multicast group address and multicast users, the multicast user is allowed to have different multicast authorities.

For instance, the multicast network operator can set all literature and art programs in multicast authority 1 and all drama programs in multicast authority 2; or set all literature and art programs as well as all news programs in multicast authority 3; according to management requirement of the multicast users, the multicast network operator can set as follows: multicast user 1 has multicast authority 1 and multicast authority 2, multicast user 2 has multicast authority 2 while multicast user 3 has multicast authority 2 and multicast authority 3, so that multicast user 1 can access all literature and art programs as well as all drama programs, multicast user 2 can access all drama programs, multicast user 3 can access all drama programs, all literature and art programs as well as all news programs.

Figure 2 is a schematic diagram illustrating mapping relations among multicast users, multicast authorities and multicast programs. Mapping relations between multicast user 1 and multicast authority 1 and 2 are one-to-many, so are the mapping relations between multicast user 2 and multicast authority 1 and 3. Mapping relations between multicast user 1 as well as multicast user 2 and multicast authority 1 is many-to-one, and so is the mapping relation between multicast user 2 as well as multicast user 3 and multicast authority3. Mapping relations between multicast authority 1 and multicast program 1, multicast program 2, multicast program 3 and multicast program 4 are one-to-many. Mapping relations between multicast authority 3 and multicast program 5, multicast program 6 and multicast program 7 are one-to-many. Mapping relations between multicast authority 1 as well as multicast authority 2 and multicast program 4 is many-to-one.

Based on the above setting, when the multicast user joins in a certain multicast group

to utilize the multicast services, the multicast user should be processed according to the above setting. The specific method is: when the multicast user wants to join in a certain multicast group to utilize the multicast services, the multicast user sends a request packet that includes an IGMP-based request packet. The level-2 network equipment or level-3  
5 network equipment can obtain the request packet sent by the multicast user by way of IGMP Proxy technique or IGMP Snooping technique. After obtaining the request packet, the network equipment can determine whether the multicast user is authorized to utilize the multicast service according to information carried in the request packet.

Subsequent processes after snooping the request packet will be illustrated hereinafter  
10 with reference to the accompanying Figure 3.

Step 300: the level-2/level-3 network equipment utilizes IGMP Proxy technique or IGMP Snooping technique to snoop the IGMP-based request packet sent by the multicast user; when the IGMP-based request packet sent by the multicast user is snooped, execute step 310; determine the multicast user's address information according to the VLAN ID  
15 carried in this request packet and/or the frame number, slot number, port number and IP address from which the request packet is sent.

Step 320: determine whether the multicast user corresponds to a multicast authority according to the mapping relation between address information of the multicast users and multicast authorities. If this multicast user does not correspond to any multicast authority,  
20 execute step 321 to determine whether the multicast user is a super user according to the multicast user's address information carried in the request packet; if the multicast user is a super user, execute step 340 to permit the user's using the requested multicast service, namely, adding the multicast user to the multicast address forwarding list and forwarding the multicast service stream according to the forwarding list. If the multicast user is not a  
25 super user according to the multicast user's address information carried in the request packet, execute step 350 to reject the multicast user from using the current requested service, namely rejecting to add the multicast user to the multicast address forwarding list, so that the multicast service stream will not be forwarded to the multicast user because the multicast user information is not included in the forwarding list.

30 In step 320, if it is determined that the multicast user corresponds to a multicast

authority according to the mapping relation between the multicast user's address information and multicast authorities, execute step 330. Determine whether the multicast group address carried in the request packet matches the multicast group address in the mapping relation according to the mapping relation between multicast authorities and multicast group addresses; if yes, execute step 340 to permit the multicast user to use the current requested multicast service; otherwise, execute step 350 to reject the multicast user from using the current requested multicast service.

In the embodiment of the present invention, while managing multicast users and multicast resources, relevant information concerning a multicast user's joining a certain multicast group can be obtained. For instance, a multicast user demands a certain multicast program at a certain time point, the multicast user cuts off this multicast program at a certain time point. According to the relevant information, the data like the multicast user's viewing time slice, viewing time span and viewing ratio can be accurately calculated, which is in favor of multicast network operator's operation.

While the present invention has been described with reference to preferable embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present invention, and hopefully the accompanied claims will comprise these variations and changes.